

Insecta, Ephemeroptera, Ephemerellidae, *Attenella margarita* (Needham, 1927): Southeastern range extension to North Carolina, USA

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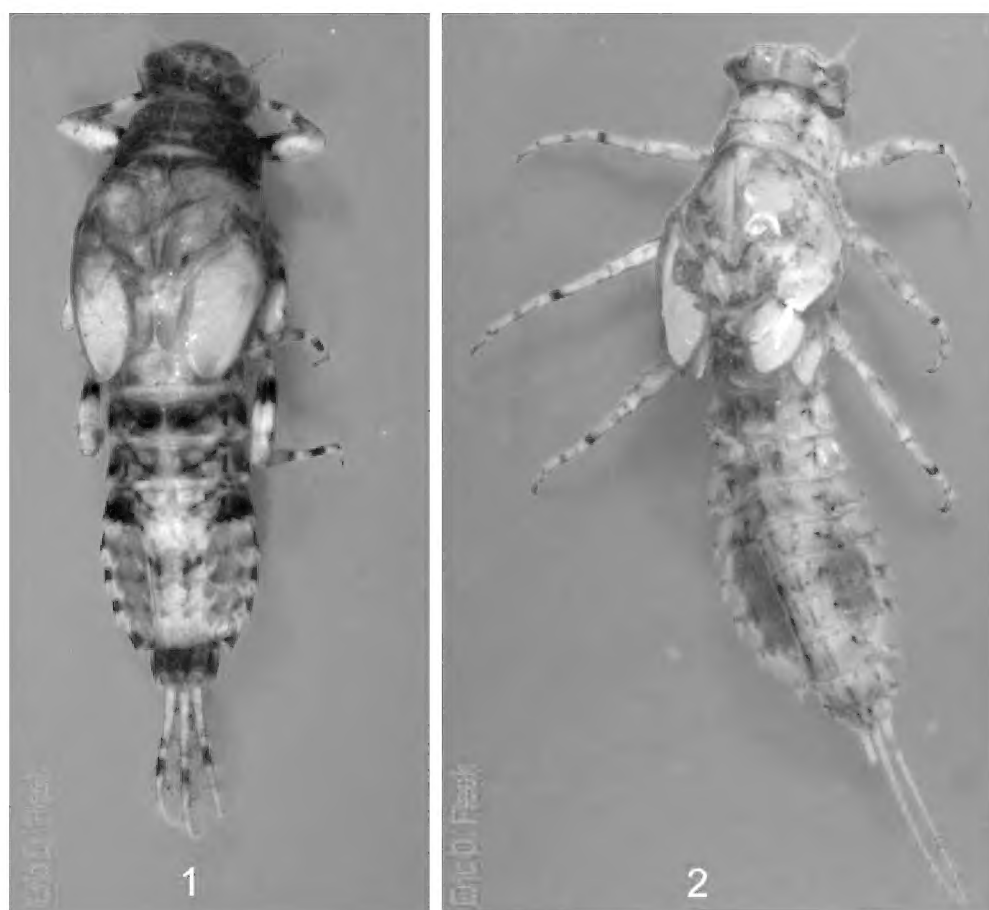
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ABSTRACT: New data from the Great Smoky Mountains, in Swain County, North Carolina, USA, extend the geographic range of *Attenella margarita* (Needham, 1927) (Insecta, Ephemeroptera, Ephemerellidae) southeast by approximately 1,300 km. We confirm that *A. margarita* has a disjunct east-west distribution in North America, which is rare among mayflies. Head, thoracic and abdominal characters for distinguishing larvae of *A. margarita* from the sympatric species, *A. attenuata* (McDunnough, 1925), are illustrated and discussed.

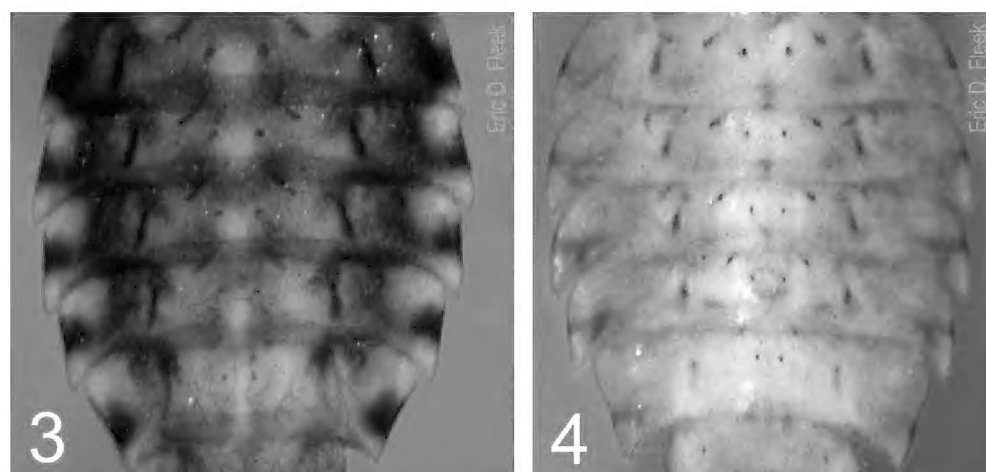
Needham (1927) described *Ephemerella margarita* Needham, 1927, (Ephemeroptera: Ephemerellidae) based on larvae from Utah, USA (Traver 1935). Allen (1980) established the present binomial combination, *Attenella margarita*, by elevating subgenera of *Ephemerella* Walsh to genus status. *Attenella margarita* larvae (Figure 1) are distinguishable from other *Attenella* Edmunds species by having the following combination of characteristics: abdominal terga four through eight with short and blunt, paired spines; most abdominal sterna with brown transverse bands on their lateral margins (Figure 3); prothorax with paired spines small (Figure 5); and occiput without paired spines (Figure 5) (Allen and Edmunds 1961). We have seen the sternal coloration pattern variably expressed on some other *Attenella* species, such as the sympatric *A. attenuata* (McDunnough, 1925), (e.g.

Figure 4), so its diagnostic utility is limited. Adults were associated with Needham's (1927) larvae tentatively by McDunnough (1931) and Allen and Edmunds (1961).

Jacobus and McCafferty (2008) recently reviewed the systematics of *Attenella*. The genus is restricted to North America and solely comprises the tribe Attenellini McCafferty of the subfamily Timpanoginae Allen. McCafferty and Wang (1994) hypothesized cladistic relationships within the genus, and McCafferty (1977; 2000), McCafferty and Wang (2000), McCafferty *et al.* (2003), Kluge (2004) and Jacobus and McCafferty (2006) have discussed its relationships to other ephemerellid genera, primarily those considered part of the subfamily Timpanoginae. Ogden *et al.* (2009) provided molecular data for *A. margarita* and discussed alternative phylogenetic placements of the genus within Ephemerellidae based on these data, introducing the possibility that *Attenella* might be an aberrant member of the group that currently is considered as the subfamily Ephemerellinae.



FIGURES 1 and 2. *Attenella margarita* (1) and *Attenella attenuata* (2), dorsal habitus.

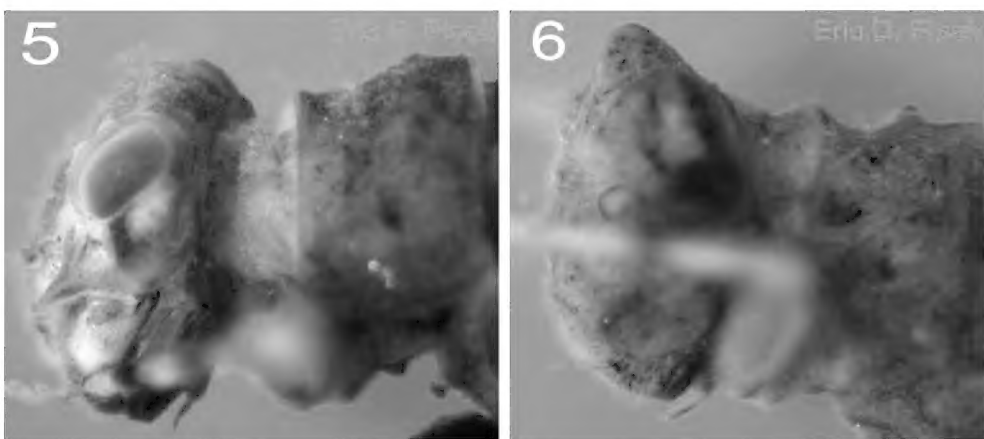


FIGURES 3 and 4. *Attenella margarita* (3) and *Attenella attenuata* (4), abdominal sterna.

Attenella margarita is relatively widespread in western North America, and it has a range that extends from British Columbia and Alberta, in Canada, south to California and New Mexico, in the USA (Allen and Edmunds 1961; McCafferty *et al.* 1997; McCafferty and Randolph 1998; Meyer and McCafferty 2008). McDunnough (1931) was

the first to report individuals attributable to *A. margarita* from an apparently disjunct eastern North American population. Since then, *A. margarita* has been recorded from an eastern range that extends from Nova Scotia and New Brunswick, in Canada, south to the USA states of Minnesota in the west and Connecticut in the east (Allen and Edmunds 1961; Lager *et al.* 1982; Burian and Bednarik 1994; McCafferty and Randolph 1998).

McCafferty and Meyer (2007a) listed *A. attenuata*, rather than *A. margarita*, as an example of a North American mayfly species with disjunct eastern and western populations. This must represent an inadvertent error, because *A. attenuata* is not known to occur any further west than Missouri and Arkansas, and the species has a somewhat continuous distribution within its range (Allen and Edmunds 1961; Berner 1977; McCafferty and Provonsha 1978; Sarver and Kondratieff 1997; Randolph and McCafferty 1998; Ferro and Sites 2007). An old misidentification of *A. attenuata* from British Columbia (Walley 1927) probably is the source of confusion. McCafferty and Randolph (1998: 58) indicated that these data (Walley 1927) were based on misidentified *A. margarita*, and they provided additional corroborating data for the latter species from British Columbia.



FIGURES 5 and 6. *Attenella margarita* (5) and *Attenella attenuata* (6), dorsal habitus.

Allen and Edmunds (1961) noted inconsistent coloration differences between the eastern and western populations of *A. margarita*, but these populations are otherwise morphologically inseparable. Allen and Edmunds (1961), Hawkins (1985) and Chandler *et al.* (2006) have discussed aspects of the biology of *A. margarita*.

We provide data that extend the recorded eastern range of *A. margarita* south by approximately 1300 km and that establish a North Carolina record for the species. These data are as follows: USA, North Carolina, Swain County, Great Smoky Mountains National Park, Eagle Creek, near mouth, 35°29'8" N, 83°46'27" W; elevation 528.2 m; 3-VIII-2005; Eric D. Fleek, Trish MacPherson, Cathy Tyndall, collectors; sample number 9679. This location is in the Little Tennessee drainage basin and the southern metasedimentary mountains ecoregion (Griffith *et al.* 2002). These record data (McCafferty 2001) substantiate Parker *et al.* (2007) inclusion of *A. margarita* in a list of species from Great Smoky Mountains National Park, USA.

Our material of *A. margarita* (Figures 1, 3, 5) was collected together with some of our *A. attenuata* comparative material (Figures 2, 4, 6) and demonstrates discreet morphological differences from the latter species, as discussed above. Additional comparative

material of *A. attenuata* was examined from the Level IV Sandhills ecoregion (Griffith *et al.* 2002) of North Carolina: Richmond County, Lumber River Basin, Naked Creek, 35°4'55" N, 79°35'25" W, 10-VII-2006, sample number 9966. All material examined is deposited with the North Carolina Division of Water Quality, Raleigh, North Carolina, USA.

Randolph and McCafferty (1998) cited McCafferty *et al.* (1993) when discussing the distribution pattern of *A. margarita*, noting "a north boreal band continuing to the extreme Northeast" from the West. McCafferty *et al.* (1993) did not document such a boreal band, and we have found no data that indicate such a continuous distribution, although it is possible. To date, *A. margarita* has not been reported from areas of central and far northern Canada and USA, and we have seen no specimens from these areas. Furthermore, McCafferty and Meyer (2007b) did not include *A. margarita* in their list of species with more or less continuous transcontinental distribution patterns. Thus, based on present record data and our observations, we conclude that *A. margarita* is a bonafide example of a mayfly species with a disjunct east-west distribution in North America, being essentially absent from the Far North and the central Great Plains.

Such disjunct east-west distributions are rare among species of North American mayflies, with only two others being documented: *Anthopotamus verticis* (Say, 1839) (Potamanthidae) and *Cinygmula subaequalis* (Banks, 1914) (Heptageniidae) (McCafferty and Meyer 2007a). Based on current taxonomy, *Ephemerella dorothea* Needham, 1908, (Ephemerellidae) could prove to be another species with a similar, disjunct east-west distribution (Jacobus and McCafferty 2003), but further study of *Ephemerella* species systematics is needed (Alexander *et al.* 2009) before this can be concluded with certainty.

ACKNOWLEDGMENTS: We thank Trish Finn MacPherson (Apex, North Carolina, USA) for drawing our attention to *A. margarita* in North Carolina through her initial identification of specimens. Comments from an anonymous reviewer helped us to improve this paper.

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RECEIVED: December 2009

REVISED: May 2010

ACCEPTED: May 2010

PUBLISHED ONLINE: June 2010

EDITORIAL RESPONSIBILITY: André V. L. Freitas